United States
Department of
Agriculture

**Natural
Resources
Conservation
Service**

SOUTH DAKOTA ENGINEERING DOCUMENTATION AND SPOT-CHECKING MANUAL

SOUTH DAKOTA ENGINEERING

DOCUMENTATION AND SPOT CHECKING MANUAL

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SOUTH DAKOTA ENGINEERING
DOCUMENTATION AND SPOT CHECKING MANUAL

REFERENCE: General Manual (GM) 450, Part 407, Documentation, Certification, and Spot Checking

These instructions outline the minimum data to be recorded in planning, installing, and checking a practice in accordance with GM, Section 450, Part 407. In many cases, data will be tabulated and computation will be made as a part of design and plan preparation that may not be reflected or shown on documentary guidelines. These data sheets will also be filed with supporting data for the practices.

Procedure:

Note Keeping, Earth Work, Surveys and Measurements, Data Sheets

A. Survey Note Keeping

1. Structural Measures

a. General Instructions - Field Notes:

1. Loose-leaf field notes shall be used for most work normally performed at the field office level, except for those practices where special job sheets are used and work is or can be expected to be of a continuing nature. The sheets of loose-leaf notebooks will be filed with the plans, computations, and other supporting data relating to the work.

   Bound field books will be used for all large jobs, group jobs, watershed, and other jobs of a continuing nature. When bound books are used, they will be properly indexed and filed. Bound books may be numbered consecutively.

2. Field survey notes will conform to standard field notes as illustrated in Technical Release 62 (TR-62). All field notes pertaining to a particular job, or notes pertaining to any phase or portion of a job, shall contain the standard survey heading which will include:

   a. Name of practice and type of survey.
   b. Cooperator's name.
   c. Location of job by legal description.
   d. Date of survey and weather.
   e. Name of survey party.
   f. Location, description, and elevation of bench marks.

   This information is customarily put at the top of the sheet on which the survey notes are kept or on the title page of the survey notes.

B. Earthwork Calculations

Earthwork calculation procedures shall be standardized in computing the final quantities required under the various progress being carried out by the Natural Resources Conservation Service (NRCS). The following outlines the methods, tables, charts, and forms that will be used when earthwork quantities are needed.

1. Earthwork quantities for dams, dikes or ditches, dugouts, etc., will be calculated as follows:

a. Where the ground conditions are described by three regular survey points:

1. Use the "three level section" method; the yardage tables as found in EFM, Supplement 1; AREAVOL software, or appropriate design software with yardage calculation capabilities. When calculating quantities by the three level section method, form SD-ENG-32 shall be used. When utilizing the excavation and embankment tables as listed above, form SD-ENG-33 will be used. If software is used for yardage computation, include the printout with practice documentation.

b. Where the base of the fill or top of the excavation is defined by more than three survey points.

1. Earthwork calculations may be made by the "any level section method" which is described in Engineering Technical Note Design SD-1, or use AREAVOL, or other applicable software. The various calculations can be made from the engineering notes. Post computation data on form SCS-ENG-529, or provide software printout.

2. As an alternative method, the survey readings and planned lines and grades may be plotted as cross sections on standard cross section sheets such as SCS-ENG-315. The horizontal and vertical scales must be large enough for accuracy. The cross-sectioned areas may then be planimetered and data posted on form SCS-ENG-529.

c. Calculations for earthwork excavation in dugouts will be made by the use of dugout tables in the EFM, Supplement 1, or by using the formula for the volume of a prismatoid (as used on Job Plan 7.0).

Dugout rehabilitation or enlargements should be surveyed by the cross-sectional method. The calculations can be based on the planimetered areas or by using the "any level section method" described in b (1) above.

Computations will be checked by the same method as original computations. For volumes calculated with various software, the calculations themselves should be considered correct but the checker must verify that the values input into the program were correct.

2. Calculations for land leveling or shaping on leveled acreages will be made as follows:

a. For land leveling jobs where payment is based on the earthwork volume, use suitable design software or the four point method (ref.: NEH 15, Irrigation, Chapter 12, Land Leveling) to determine the actual cubic yards of cut or fill.

b. The "tenths method" (ref.: NEH 15, Irrigation, chapter 12, Land Leveling) of determining balance of cuts and fills may be used for making preliminary estimates and for balancing cuts and fills when the actual cubic yards of earthwork is not a cost or payment criteria.

C. Surveys and Measurements:

1. When cubic yards are the basis of measurement for contracting or cost sharing on earthwork, all measurements for quantity will be based on engineering surveys that use an instrument and rod for determining elevations. Typical examples of practices to which these procedures will apply are: earth dams, mains and laterals, large diversions, earthwork on irrigation systems or waterspreading systems, etc.

2. When the unit of work or item is based on linear feet such as irrigation pipelines, ditch lining, etc., measurements will be made by a surveyors chain or tape, or with a total station; except that stockwater pipelines may be measured with a measuring wheel. When earthwork is based on linear feet, measurements may be made by a chain or tape, by a measuring wheel with a recorder, or with a total station.
3. When the practice is measured in acres, several methods can be used to determine quantities. For waterways, farmsteads, feedlot or field windbreaks; the measurements should be made by a tape, chain, stadia, or measuring wheel with a recorder or total station, except field windbreaks may be scaled on an aerial photo when the limits of the windbreak can be identified on the photo. For contour farming, contour stripcropping, seedbed preparation, and pasture or range seedings, the acreage can be determined by the dot count procedure or planimetering aerial photos on which the boundaries have been determined.
4. Accuracy for certifications: express rods, miles, tons, cubic yards of concrete or rubble masonry and percentage of units to the nearest tenth. Express linear feet, pounds and cubic yards, or other materials in whole numbers. In calculating volumes of fill or excavation, compute the yardage between any given stations to the nearest tenth and arrive at a total to the nearest cubic yard.

   For earth embankments constructed using method type compaction (ref.: construction specification SD-7S), the total cubic yards of embankment will include the volume of earthwork to the design grade plus a five percent increase for settlement. For embankments constructed with overfills in excess of five percent, the volume of embankment over the five percent overfill will not be certified for payment. This five percent increase for settlement does not apply to any other practices even though the practice certification may be based on cubic yards of fill.

D. Other Supporting Data - (Forms - Construction Plans - Specifications, etc.):
1. The data sheets to be completed for structural practices are shown on the form index. Some practices require several sheets to properly record information, such as: hydraulic and hydrologic determinations, material estimates, cross-sections, profiles, seeding. The more simple practices will normally require only one completed data sheet.
2. Some of the sheets require planned data to be posted when the conservation measure is planned and laid out in the field. Additional columns or lines are provided for the final constructed elevations, dimensions, quantities, or other items which are posted by the technician when checking the final construction. The data sheets are not complete until all columns or applicable blanks are filled out as required.
3. "As Built" construction plans and specifications for structural practices are considered supporting data. Where standard specifications are used with no modifications or additions, a list of the standard specifications furnished is adequate.
4. Minimum required specifications for vegetative and management-type conservation practices should be recorded on appropriate worksheets, except specifications for non-cost-shared practices or non-contract items may be recorded either on appropriate worksheets or in the conservation plan decision statement.
5. It is recommended that there will be timely inspections of the following engineering structures as they are being constructed: earth dams, agricultural waste management

system (AWMS) facilities, drop structures, tile drains, canals and ditches, land leveling, waterways, terraces, and diversions.

The purpose of these inspections is to determine that the structures are being constructed according to plans or drawings and specifications. The person making the inspection will record finding on form SD-ENG-19, Construction Inspection Report. The report will contain observations as to the quality of work, instructions given to the contractor or the landowner, and other pertinent information. A reminder list is on the back of these forms to assist the technician in determining items to be checked. These completed forms will be filed with the completed data sheets to show what inspections were made and to support certifications.

E. Variations between Planned and Constructed Sections:

The constructed section shall equal or exceed the planned section within tolerable limits. It should be possible to superimpose the completed cross sections and/or profiles upon the planned cross section or profile within tolerable limits and with allowance for settlement.

If the practice is constructed significantly different than designed; the practice must be reconstructed to meet the original design, or the as-constructed practice may be accepted, if, upon complete evaluation, it is shown to be acceptable (complete documentation and recalculation of as-built quantities required).

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I. General

The covered practices are listed in alphabetical order. Documentation and supporting data requirements may be similar for more than one practice. Where this occurs in the manual, a "primary practice" is used to include conservation practices with similar requirements.

The index contains an alphabetical listing of the included conservation practices. Opposite each practice is the name of the "primary practice" containing the documentation and supporting data requirements.

Only those engineering practices normally encountered in South Dakota requiring documentation and supporting data are represented in the Documentation and Spot Checking Manual (DSCM). Guidelines for documentation and supporting data for the seldom used practices, where cost-sharing is involved or the operator has requested NRCS technical assistance, can be found in the General Manual (GM), Section 450, Part 407.10, the standard pertaining to the practice, and the general format as outlined herein.

The instructions for documentation and supporting data contained herein are intended to supplement and complement the South Dakota Technical Guide (SDTG) and the National Engineering Manual (NEM). If items contained in this manual conflict, the NEM and SDTG will govern.

II. Format

Engineering records usually consist of the following items as outlined below which were generally followed as the format of the DSCM for the engineering practices:

A. GENERAL
   1. References

B. INVESTIGATIONS AND SURVEYS
   1. Design Investigations
   2. Design Surveys
   3. Environmental Inventory

C. DESIGN
   1. Design Data
   2. Permits

D. CONSTRUCTION PLANS AND SPECIFICATIONS
   1. Construction Plans
   2. Construction Specifications

E. LAYOUT
   1. Layout Surveys
   2. Earthwork Quantity Computations

F. COMPLIANCE CHECKING - "AS BUILT" PLANS
   1. Compliance Checking

2. "As Built" Plans

III. Field Surveys

Field surveys are usually made for one or more of the following purposes:

A. Feasibility
Those surveys and determinations that are made at a site for purposes of determining feasibility or practicability. These surveys are usually of an investigational nature consisting of random instrument readings and normally it is not required to maintain formal notes on them unless such information is to be incorporated into subsequent surveys.

B. Design
Those surveys and determinations that are made at a site for purposes of developing a design and construction plan for the practice.

C. Layout
Those surveys and determinations that are made for the purpose of laying out parts or all of the work planned for construction and establishing quantities of the work to be completed.

D. Construction
Those surveys and determinations that are made during construction of the work for purposes of evaluating construction accomplished or ascertaining quantities of work done.

E. Compliance
Those surveys and determinations that are made at the completion of construction of the work for purposes of determining compliance with approved plans and specifications, or for the purpose of evaluating quality control activities, such as spot checking.

For small jobs on some practices, it is considered feasible to combine surveys under one operation during one trip to the field. More complex jobs usually require separation of surveys.

For practices with components that are designed to specific lines or grade, elevations shall be controlled by establishment and recording of at least one known elevation benchmark. Elevation of benchmarks for the smaller individual jobs may be either assumed or actual elevations. All benchmarks shall be clearly described as to identification and location.

IV. Field Notes

Field survey notes are one of the basic foundations of all our engineering design and construction. There are minimum basic requirements that must appear in completed field note records. The requirements for survey field notes are outlined in the GM, Section 450, Part 407.01, and Technical Release 62 (TR-62).

V. Design Data Other Than Surveys

In the design and planning of many practices, it is essential to gather and compile data other than survey information. This may consist of any or all of the following:

A. Soil mechanics information including soil profiles, soil classification, samples, and geological reports.

B. Soil survey information on limitations and treatment.

C. Hydrologic information including drainage areas, peak flood information, soil cover complexes, and hydrologic soil groups.
D. Hydraulic information including design quantities, capabilities, velocities, etc.
E. Materials information including quality and quantity.
F. Known cultural resource sites recorded on State Archeological Resources Management System (ARMS) web site.
G. Review of certified wetland determinations.

In many cases of small, simple jobs, it is possible to carry out design and layout operations during one trip to the site. Under these circumstances, the required design factors can usually be determined on-the-job. Appropriate determinations are then transferred to standard plan drawings. Quantity computations are made on computation sheets or quantities are selected from prepared tables on standard plans. All computation sheets and copies of job plans ("As Built" plans) are made a part of the technical file for the job.

In the more complex jobs, basic field information such as profiles, cross-sections, topography, etc., are taken in the field and returned to the office for design of the job. In these cases, design factors, computations, etc., are usually compiled or determined in the office. Necessary information from this material is used to develop the plan drawing and standard or written specifications for the work. All such data is made a part of the official job file. After this has been done, the work is laid out for construction.

VI. Data Forms

An index of general-purpose forms is provided with attached forms. This index also gives a brief explanation of use of the forms except those where titles are self-explanatory. Data forms used for specific practices will be found in the instructions for the practice.

The forms or data sheets listed in the instructions are those normally used in the processing of the practice. The variability and complexity of the practice will dictate the use of the listed forms or other additional forms or data sheets not listed. All pertinent supporting data should be in the official job file or referenced to the official files at the completion of the work.

To reduce repeating the instructions, form identification numbers normally used for most practices are omitted from the individual practice documentation requirements. For example, survey instructions will not refer to field notebook forms SCS-ENG-28 and SCS-ENG-29; and earthwork computations will not normally refer to the forms to be used, etc.

VII. Other

Detailed instructions on factors such as frequency of cross-sections, profile stationing, slope stakes, etc., have purposely been held to a minimum because of the wide range of needs encountered in the field. Each individual is expected to exercise sound engineering judgment or secure guidance from an engineer.

On multiple component type practices, such as waterspreading, agricultural waste management, critical area treatment, etc., the documentation will be as outlined in the practice in addition to the documentation requirements for each practice component used in the system.

INDEX

CONSERVATION PRACTICE	CODE	PRIMARY PRACTICE (Practice with DSCM Requirements)
TO FIND REQUIREMENTS FOR THIS PRACTICE		**LOOK HERE.**
Bio-Engineering	580	Streambank and Shoreline Protection
Dam, Diversion	348	Earth Dams
Dam, Floodwater Retarding	402	Earth Dams
Dam, Multiple-Purpose	349	Earth Dams
Diversion	362	Diversions
Floodwater Diversion	400	Diversions
Grade Stabilization Structure (Earth)	410	Earth Dams
Grade Stabilization Structure (Structural)	410	Grade Stabilization
Grassed Waterway or Outlet	412	Grassed Waterway
Irrigation Land Leveling	464	Irrigation Land Leveling
Irrigation Pit	552-A	Excavated Farm Pond (Dugouts)
Irrigation Regulating Reservoir	552-B	Earth Dams
Irrigation Storage Reservoir	436	Earth Dams
Irrigation Water Conveyance Irrigation Pipeline (All)	430	Irrigation Pipeline (All)
Pipeline	516	Pipeline
Pond (Dam)	378-A	Earth Dams
Pond (Dugout)	378-A	Excavated Farm Pond (Dugouts)
Sediment Basin	350	Earth Dams
Sediment Basin (AWMS)	350	Waste Management Structure
Spring Development	574	Spring Development
Streambank and Shoreline Protection	580	Streambank and Shoreline Protection
Structure for Water Control	587	Grade Stabilization Structure
Subsurface Drain	606	Subsurface Drain
Terrace	600	Terrace
Trough or Tank	614	Trough or Tank
Waste Management System	312	Waste Management Structure
Waste Storage Facility	313	Waste Management Structure
Waste Treatment Lagoon	359	Waste Management Structure
Waterspreading	640	Waterspreading
Well (Stock and Domestic)	642	Well (Stock and Domestic)

FORM INDEX
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Forms: The following forms are normally considered general purpose forms. Forms for specific practices will be found under the practice requirements.

FORM	TITLE	USE
SD-ENG-2 (1/02)	Certification Statement – Practice Component	For certification of compliance for components of a practice which cannot be directly measured or checked after construction, such as core trench, etc. Form to be completed with designed dimensions, cuts, etc. entered by NRCS before presenting to owner or contractor, who enters "As Built" data before signing. (REF.: GM, 480, Part 407.11)
SD-ENG-3 (1/02)	Grassed Waterway	Use for waterway design data, layout, construction plan and construction check for small waterways (Class I or II).
SD-ENG-4 (1/02)	Certification Statement Regarding State Water Laws	Upper portion can be filled out and given to operator for use in completing applicable forms to comply with state water laws. This lower portion, either section 1 or 2, is to be given to owner prior to layout certifying his intent to comply with state water laws. This is retained in the NRCS project job file. (REF.: GM, 450, Part 405.03)
SD-ENG-5 (1/02)	Hydraulic Elements - Pipeline Design	Hydraulic calculations for pipeline design (pumped systems).
SD-ENG-5B (1/02)	Hydraulics - Gravity Pipeline Design	Hydraulic calculations for gravity pipeline design with capability to document losses and flow capacity at each riser outlet.
SD-ENG-5C (1/02)	Stockwater Pipeline Design Data	Hydraulic calculations and design capacities for stockwater pipelines.
SD-ENG-7 (1/02)	Surface Irrigation Design Sheet	Design data for surface irrigation systems.

FORM	TITLE	USE
SD-ENG-9 (1/02)	Basic Data Sheet for Sprinkler Irrigation Systems	Basic data sheet for sprinkler irrigation system design.
SD-ENG-9a (1/02)	Sprinkler Irrigation Design	Sprinkler irrigation design computations for set-type sprinkler systems.
SD-ENG-10 (1/02)	Earth Borings Documentation	Worksheet for recording detailed logs of earth borings.
SD-ENG-11 (1/02)	Participant Responsibilities	Used to inform operators of their responsibilities when installing conservation practices for permitting, easements, cultural resources, inspections, and O&M.
SD-ENG-12 (1/02)	Table of Quantities and Cost Estimate	For use by owner or operator. Cost estimates are not a part of construction plans.
SD-ENG-15 (1/02)	Permit For Site Assessment Surveys	Permit for investigation surveys where such permit is not covered by other documents, such as cooperative agreements, easements, etc.
SD-ENG-27 (1/02)	Computations for Water Surface Profile	Worksheet for computation of water surface profiles.
SD-ENG-29 (1/02)	Hydrologic Data Sheet	General worksheet for computation of peak flows, storm volume, and annual yield. Reverse is worksheet for hydraulic computations for any spillway, ditch, diversion, waterway, principal spillway, or culvert.
SD-ENG-32 (1/02)	Earthwork Computation Sheet (for Three Level Section)	Computation of cross section area of any cut or fill section described by three points.
SD-ENG-33 (1/02)	Earthwork Computation Sheet	Computation of cross section area using tables in section 4 or 5 in Appendix No. 1.
SD-ENG-45 (1/02)	Log Sheet For Soil Borings	Worksheet for recording logs of earth borings and description of material. Can be used by well drillers for logging if desired.
SD-ENG-47 (1/02)	Water Storage Capacity Worksheet	Used to document storage requirements for stock tanks.

FORM	TITLE	USE
SD-ENG-48 (1/02)	Pipeline	Pipeline data, design, and plan sheet for small pipelines (Class I).
SD-ENG-49 (1/02)	Concrete Batch Certificate	Data to be furnished by ready mix plant for concrete mix supplied to job site.
SD-ENG-50 (1/02)	Well Plugging (Decommissioning) (351)	Instructions and specifications for plugging wells and certifying to DENR.
SD-ENG-51 (1/02)	Wells (624) (Record of Installation)	Well completion report to be filled out by driller /Well certification by NRCS.
SD-ENG-52 (1/02)	Excavated Pond (Dugout) Installation and Check Data	Excavated pond layout by contractors and hand level construction check.
SD-ENG-53 (1/02)	Cathodic Protection data Form	Monitoring adequacy of cathodic protection for steel pipe and structures.
SD-ENG-54 (1/02)	Determination of Size of Confined Livestock Operationss	Used to determine total number of animal units for feedlots (follows method used for state permitting).

The following forms are available, but not included in index:

FORM	DESCRIPTION
SCS-ENG-522 & -522A	Computation Sheet 4x4 to 1”
SCS-ENG-523 & -523A	Computation Sheet 5x5 to 1”

The following “E” sized (21” x 30”) forms are available, but not included in index:

FORM	DESCRIPTION
SCS-ENG-313	Plan Sheet - fade out blue cross section 8 x 8
SCS-ENG-313B	Plan Sheet - fade out blue cross section 10 x 10
SCS-ENG-313-C	Plan Sheet - plain
SCS-ENG-314	Plan Sheet - plain linen
SCS-ENG-315	Cross Section - 10 x 10
SCS-ENG-316	Profile
SCS-ENG-317	Plan one-half - Profile one-half
SCS-ENG-318	Plan two-thirds - Profile one-third

The following “N” sized (10 ½ x 15”) forms are available, in addition to form SD-ENG-42, but not included in the index:

FORM	DESCRIPTION
SCS-ENG-349	Cross section 10 x 10
SCS-ENG-351	Profile

DIVERSION

Diversion (362)
Floodwater Diversion (400)

I. GENERAL

A. References
1. EFM, Chapters 3 and 9.
2. Computer Software EFM2, TR-55, Ohio.
3. NRCS-TP-61, Handbook of Channel Design.
4. South Dakota Engineering Technical Notes.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil borings - where needed to determine classification of soils for allowable design velocities and construction materials. Use form SD-ENG-45, Log Sheet for Earth Borings or field notebook.
2. Location of underground utilities.

B. Design Surveys[1/]
Record in standard field notebook or form SCS-ENG-28 and -29.
1. Description, location, and elevation of benchmarks.
2. Sketch of diversion location, direction of flow, etc.
3. Average land slope along proposed centerline. For significant land slope changes, divide diversion into reaches.
4. Profile along centerline of ditch.
5. Data on bridges and culverts which affect diversion design.

C. Environmental Inventory
National Environmental Policy Act (NEPA) inventory of resources - document inventory on form SD-CPA-3.
1. Cultural resources inventory- use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited Minimal Effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a Minimal Effect Agreement must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

[1/] On the smaller jobs the design surveys can be combined with the layout surveys; dependent on judgment and experience of technician.

III. DESIGN

A. Design Data

1. Hydrology - for each reach - record on forms SD-ENG-29, -29a, or use EFM2 hydrology software.
2. Hydraulics - hydraulic elements of the diversion, i.e., cross section, slope, and capacity for each reach. Record on forms SD-ENG-29, -29a, or applicable software.
3. Quantity and cost estimates (SD-ENG-12).

B. Permits and Approvals (if applicable)

1. 404 Permit - document if individual permit obtained, nationwide permit applies, or if practice is exempt.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use South Dakota standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of "E" (21" x 30,") 11"x17," or "N" (10 1/2" x 15") sized, drawing sheets.

Use Job Plan No. 8.1, Form SD-ENG-42 or SCS-ENG-313B or other applicable "N" or "E" sized standard forms.

1. Overall plan view - show the following:
   a. Overall plan view showing alignment, stationing, and other significant cultural features affecting construction.
2. Profile of designed channel and ridge superimposed on original centerline of ditch.
3. Cross sections - minimum of one cross section for each design reach showing bottom widths, side slopes, etc.
4. Location or vicinity map - Class IV or larger - show location of work from nearest city, town, etc. All others - location map with legal description. Use United States Geological Survey (USGS) quadrangle maps.
5. Construction notes - add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. **Construction Plans for diversions shall include the following statement: "According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
6. Table of quantities estimates - place on plans.
7. Job approval – Ref.: NEM, Part 501.
8. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref: South Dakota Specification Guide for the intended practice.

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys

On small jobs, layout surveys may be combined with design surveys. Use standard staking procedure (TR-62 Engineering Layout, Notes, Staking & Calculations). Record in field notebook or forms SCS-ENG-28 and -29.

1. Centerline, slope, and reference stakes.
   a. Set stakes at maximum 100-foot intervals and necessary plus stations at grade or land slope changes.
   b. Set a minimum of one slope stake or one centerline stake at each station.
2. Obtain sufficient cross sections to determine accurate volume, if volume is basis of payment.

B. Earthwork Quantity Computations

Compute by average end area method if volume is the basis for payment. Final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance Checking

Record in field notebook (form SCS-ENG-28 and -29) or job sheet as applicable.

1. Profile of completed channel bottom and ridge.
2. Cross sections showing bottom width, depth, side slopes, berm widths, etc. Check at least one cross section for each design section or reach.
3. Completed length.
4. Vegetative measures - statement regarding status of seeding or sodding.
5. Construction inspection reports - form SD-ENG-19 (ref.: NEM, 512.32).
6. Statement of compliance - state that construction is complete according to plans and specifications. This should be dated and signed by the person with proper job approval authority.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising job approval authority in accordance

with NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[2/] design changes.
2. Significant[2/] changes in linear measurement.
3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.

[2/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

EARTH DAM

Dam, Diversion (348)
Dam, Multiple Purpose (349)
Pond (378)
Floodwater Retarding Structure (402)
Irrigation Storage Reservoir (436)
Irrigation Regulating Reservoir (552-B)
Sediment Basin (350)

I. GENERAL

A. References

1. EFM.
2. EFM, Supplement No. 1.
3. SDTG, Section IV.
4. South Dakota Standard Engineering Plans (Job Plans).
5. Technical Release 20, 55, 60, and others.
6. South Dakota Engineering Technical Notes.
7. Computer Software - Iowa Ponds, Sites 98.0, EFM2, TR-55.
8. NEH, Sections 5, 6, 19, and 20.
9. USGS Water Resources Investigation Report 98-4055.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations

1. Soil borings- record on form SD-ENG-45 or SD-ENG-10.
   a. Classification by Unified Soil Classification System.
   b. Determine foundation conditions.
   c. Locate borrow material.
2. Corrosion potential.
   a. Resistivity readings or published data.
3. Location of underground utilities.

B. Design Surveys

On smaller projects the design survey may be combined with the layout survey, depending upon the experience and judgment of the technician.

1. Topographic mapping.
   a. Irrigation Storage Reservoir, Floodwater Retarding, and Multiple Purpose Dams - develop topographic map of reservoir area and dam site in sufficient detail to adequately design structure.
   b. Other Earth Dams - as needed, depending on site conditions and project needs. Surveys must be adequate in nature and extent to provide accurate design values.
2. Profiles and cross sections - record in field notes
   a. Centerline of embankments.
   b. Centerline of emergency spillway - from below inlet section to a point beyond control section to establish exit channel slope on Ponds (378) and down to base grade of outlet channel on all other earth dams.

c. Centerline of principal spillway far enough downstream to determine tailwater conditions.

d. Grade stabilization dam - profile in channel upstream and downstream from structure including area protected.

e. Cross section at maximum fill section (minimum, depending on size, and type of structure).

f. Cross section of emergency spillway at control section.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.

1. Cultural resources inventory - use form SD-SSC-1.
2. Wetland effects.
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a Minimal Effect Agreement must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design Data - record on standard data sheets and/or appropriate worksheets.

1. Hydrologic data - peak flow, storm runoff, annual yield (form SD-ENG-29 or -29a, EFM 2, TR-55, SITES98).
2. Hydraulic data - emergency spillway, principal spillway, drawdown pipe, outlet channel (form SD-ENG-29 or -29a, OHIO, SITES98, Iowa Pond).
3. Structure data - surface area, storage, sediment volume. Stage-storage, depending on structural needs.
4. Structural design computations, depending on structural needs.
5. Quantity and cost estimates (SD-ENG 12).

B. Dam Hazard Classification.

Dam hazard classification must be documented by the individual with Job Approval Authority (NEM, 520.23).

C. Permits and Approvals (if applicable).

1. 404 Permit - document if individual permit obtained, nationwide permit applies, or if practice is exempt.
2. Safety of dams - when a structure is classified as a 'dam' by the SD DENR, the design shall be submitted to DENR for approval (see GM, 450, Part SD 405, for classification information).
3. Water rights - owner is responsible for obtaining water rights from SD DENR or properly filing a Location Notice; see GM, 450, Part 405. Document with form SD-ENG-4.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans.

Use South Dakota standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation

instructions. Larger or more complex structures may require use of "E" (21" x 30,") 11"x17," or "N" (10 1/2" x 15") sized, drawing sheets.

1. Plan view of dam and reservoir area.
2. Profile and cross section of emergency spillway.
3. Profile on centerline of embankment and cross section at maximum fill section (minimum, depending on size and type of structure).
4. Core trench profile and typical cross section.
5. Show elevations, slopes, dimensions, and stationing on profiles and cross sections.
6. Show location and extent of borrow area.
7. Principal spillway and drawdown pipes.
   a. Profile on centerline.
   b. Show stationing, dimensions, elevations.
   c. Show location of related appurtenances such as cutoff collars, pipe supports, gates, etc.
   d. Show skew angle on plan view of dam.
8. Structural details - as needed to clarify drawings.
9. Log of soil borings - show on plans for larger or more complex structures and on structures of any size where subsurface material or water may be significant for construction.
10. Table of quantities - estimates.
11. Location or vicinity map - with legal description.
12. Construction notes - add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. **Construction plans for earth dams shall include the following statement: "According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
13. Job approval - see NEM, Part 501.
14. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications - ref.: South Dakota Specification Guide for the intended practice.

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys.

1. Centerline alignment stakes.
2. Offset grade stakes for principal spillway, drawdown pipe, irrigation supply conduit, etc., as necessary.
3. Slope or construction stakes for embankment and emergency spillway.
4. Location and grade stakes for structural components.

B. Earthwork Quantity Computations.

1. Compute quantities in embankments, dikes, cutoff trench, and other excavations as needed.
2. Methods to be used in making computations of quantities:
   a. EFM, Supplement No. 1 (SD-ENG-33).
   b. Three-level section (SD-ENG-32).
   c. Any level method (SCS-ENG-529, Technical Note, Engineering Design SD-1).
   d. Computer software - Area Vol., Ohio Cross-Sections with Quantities.
3. Compute quantities from layout notes. Final quantities are based on staked lines and grades and/or approved changes.
4. Show quantities of all components in the table of quantities on the plans.

VI. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance Checking - record on field notes or construction plans (SD-ENG-19).

1. Profiles on centerline of embankments, channels, emergency spillway, and pipelines.
2. Cross sections of emergency spillway, dam embankment, outlet channels.
3. Elevations at inlet and outlet of principal spillway and other pipes and control elevations of all structures.
4. Pipes - check length, gauge, thickness, type, diameter.
5. Number, type, location of appurtenances (gates, valves, trash racks, etc.).
6. Dimensions of appurtenances (trash racks, anti-vortex devices, pipe supports, etc.)
7. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
8. Material certification statement (ref.: NEM, Part 512, Subpart C).
9. Statement of compliance - state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising Job Approval Authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.

[1/] Determination of “significant” is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.P

EXCAVATED FARM PONDS (Dugouts)

Livestock Water Pond (378-A)
Irrigation Pit (522-A)

I. GENERAL

For purpose of practice documentation there are two types of excavated ponds (dugouts):

Type "A" - Ordinary excavated ponds (dugouts) for stock water purposes. Normal spoil placement. Yardage calculations will not be required for each dugout. Unit of measure will be one unit. This is based on the minimum volume of the normal sized dugout constructed in the county by drag line and/or that constructed by scraper. When cost-sharing programs are involved, needs and/or certification will be by unit followed by the minimum volume; i.e., 1–2000. Form SD-ENG-52(a) is used for Type "A" dugouts.

Type "B" - Excavated ponds (dugouts) for purposes other than stock water and dugouts for stock water requiring special consideration. An example of special consideration would be the use of spoil to construct embankments below dugouts. Yardage and other design calculations are normally required for this type of dugout. Job Plan 7.0 or form SD-ENG-52 or -52(a) is used for Type "B" dugouts, depending on NRCS assistance.

A. References
   1. SDTG, Section IV, (378-A), (522-A).
   2. EFM.
   3. NEH, Appendix No. 1.
   4. South Dakota Engineering Technical Note: Construction, SD-5 (for Contractor Staking).
   5. South Dakota Engineering Technical Note - Contractor Dugout Checking Procedure, SD-6.
   6. GM - Technical Development and Application, Title 450, Part SD405.03, (Compliance with State Water Laws and Regulations).

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
   1. Soil borings - as needed. Classify by Unified Soil Classification System. Record on standard Job Plan 7.0, SD-ENG-52 or -52(a), or form SD-ENG-45. Where borings are not used, indicate source of soils evidence that practice will function as required.
   2. Ground water elevation.
   3. Drainage area - for dugouts supplied by surface runoff.
   4. Location of underground utilities.

B. Design Surveys
   1. Type "A" pond supplied by contractor.
   2. Type "B" pond -In most cases, the design survey is combined with the layout survey and recorded on Job Plan 7.0, Excavated Pond.
      a. Topographic information - as needed to determine location of spoil materials, embankments, pipes, etc.

b. Profile and cross sections on enlargements - on dugout enlargements or surveys to compute the volume of earthwork by average end area methods, a minimum of seven cross sections should be taken as follows: top ends, one-half distance down end slopes; bottom edges; center.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.

1. Cultural resources inventory - use form SD-SSC-1.
2. Wetland effects (if applicable):
   a. Complete form SD-CPA-10, South Dakota Minimal Effects Procedure. If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a Minimal Effect Agreement must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design Data

1. Hydrologic data - use form SD-ENG-29 or -29a.
   a. Where dugout depends on surface runoff - compute annual yield or document adequacy of drainage area used.
   b. Compute peak design flows where emergency spillways are required.
2. Hydraulic data - emergency spillway capacity and design where channel is restricted by excavated material. Use form SD-ENG-29 or -29a.
3. Dimensions of pond - dependent on runoff, site conditions, and water needs.
4. Earthwork quantity estimates - where earthwork volume is needed (Type "B" pond).
5. Structure data - surface area, storage, etc. If needed, use Job Plan 7.0.

B. Permits and approvals (if applicable)

1. 404 Permit - document if individual permit obtained, nationwide permit applies, or if practice is exempt.
2. Water rights - owner is responsible for obtaining water rights from SD DENR or properly filing a Location Notice; see GM, 450, Part 405. Document with form SD-ENG-4.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

1. Type "A" Pond

   The following design information will be included on SD-ENG-52 or -52(a):
   a. Bottom dimensions.
   b. Side and end slopes.
   c. Design (minimum) depth.
   d. Log of borings (as needed).
   e. Spoil placement, berm width.
   f. Construction notes - add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. **Construction plans for excavated ponds shall include the**

following statement: "According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."

g. Location map.

h. Job approval - ref: NEM, Part 501.

2. Type "B" Pond

Use Job Plan No. 7.0, or SD-ENG-52 or -52(a) where procedure in South Dakota Engineering Technical Notes Construction SD-5 (Layout of New Excavated Ponds by Conservation Contractors) or SD-6 (Excavated Pond Hand-Level Construction Check Procedure) is used.

a. Overall plan view.

1. Bottom dimensions.
2. Side and end slopes.
3. Depth of cuts.
4. As needed, show location or disposition of spoil piles, embankments, emergency spillway if any, and other significant features affecting construction.

b. Cross section - show width and length cross sections if needed for clarification.

c. Log of soil borings or soils evidence that practice will function as required.

d. Construction notes - add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction Plans for excavated ponds shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**

e. Location map.

f. Table of quantities estimates - place on plan.

g. Job approval - ref.: NEM, Part 501.

h. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: South Dakota Specification Guide for the intended practice.

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys

1. Type "A" ponds

   No layout surveys required by NRCS (contractor may set stakes for his own construction purposes).

2. Type "B" ponds

   Usually combined with the design survey - when Job Plan 7.0 is used.

   a. Locate bottom corners and set grade and slope stakes for 17-point method.

   b. Set alignment and grade stakes for embankments, emergency spillways, and pipes if used. If excavated material is placed across the natural channel, adequate spillway provisions must be made. If water impounded against embankment exceeds three feet, follow embankment specifications for earth dams.

   c. Reference stakes to benchmark. Record location and elevation.

   d. Earthwork quantity - final quantities are based on staked lines and grades or approved changes.

      1. Compute volume of excavation. Use either tables in Appendix No. 1 or volume computation section on back of Job Plan 7.0.

      2. Enlargements of existing dugouts - use form SD-ENG-32 where volumes are required. Average end areas are used to compute volume. Use either "any level section method" or planimeter to obtain end areas. Refer to Design Surveys II, B, 2, for instructions on cross-sections.

VI. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance Checking

1. Type "A" Ponds

   Where that volume is <u>not</u> required and contractor does compliance checking - use form SD-ENG-52 or -52(a).

   a. Contractor completes cross-sections to show that construction meets planned dimensions.

   b. Contractor certifies completion on form SD-ENG-52 or -52(a) and returns form to NRCS or gives to owner to return to NRCS.

   c. NRCS reviews contractor's certified form and signs to indicate concurrence that data furnished by contractor complies with design.

d. Spot-checks will be made by the field office for quality control. The minimum will be 1 per county or 10 percent, whichever is greater. These quality control spot checks are in addition to the regular spot-checking as outlined in GM, 450, Part 407.20.

2. Type "B" Ponds

Where earthwork volume in cubic yards is required and NRCS has staked - record in field notes or Job Plan 7.0.

a. Take width and length cross sections.

b. Check elevations and dimensions of other components such as designed embankments or emergency spillway.

c. Compute average bottom rod reading and compare to required grade rod.

d. Plot width and length cross sections and superimpose on design cross-sections, if needed, for clarification and adequacy.

e. Construction inspection reports - ref.: NEM, 512.41.

f. Statement of compliance - state that construction is complete according to plans and specifications. This should be dated and signed by the technician making the determination.

B. "As Built" Plans - ref.: NEM, 512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of the need for "As Built" plans will be made by the person exercising Job Approval Authority in accordance with NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

GRADE STABILIZATION

Grade Stabilization Structure (410)
Structure for Water Control (587)

I. GENERAL

A. References
1. SDTG.
2. EFM, Chapters 6, 14, and 17.
3. South Dakota Standard Plans.
4. NEH, Sections 6, 11, 14.
5. South Dakota Engineering Technical Notes.
6. Technical Releases TR-20, TR-55, TR-60.
7. Computer Software - Iowa Ponds, Sites 98.0, EFM2, TR55.
8. USGS Water Resources Investigation Report 98-4055.

II INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil borings - where needed to determine foundation materials and characteristics for design. May include geological site investigation. Use form SD-ENG-10, Log Sheet, SD-ENG-45, or field notebook to record.
   a. Classification by Unified Soil Classification System.
   b. Determine foundation conditions.
   c. Locate borrow material.
2. Corrosion Potential
   a. Resistivity readings or published data.
3. Location of underground utilities

B. Design Surveys

On smaller jobs (standard plan size), the design survey may be combined with the layout survey depending on judgment and experience of technician. Record in field notebook or data collector.
1. Site topography - as needed to show physical features of structure site.
2. Centerline profiles and cross sections - to establish structural proportioning and elevations.
   a. Centerline, at location of structure.
   b. Centerline of emergency spillway - from below inlet section down to base grade of outlet channel on grade stabilization dams.
   c. Centerline of principal spillway far enough downstream to determine tailwater conditions.
   d. Profile in channel upstream and downstream from structure.
   e. Cross section at maximum fill section (minimum, depending on size and type of structure).
   f. Cross section of emergency spillway at control section.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.

1. Cultural resources inventory - use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited Minimal Effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a Minimal Effect Agreement must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design data
   1. Compute capacity requirements, discharge, frequency, etc. Use EFM2 or other method.
   2. Design grade and profile.
      a. Ditch or channel bottom.
      b. Water surface.
   3. Hydraulic analysis and determinations (capacity of ditch or channel and structure).
   4. Structural analysis (not required on standard plan sized structures).
   5. Material volume computations - includes earthwork estimates.

B. Permits and approvals (if applicable)
   1. 404 Permit - document if individual permit obtained, nationwide permit applies, or if practice is exempt.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction plans

Use South Dakota Standard Plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures require use of "N" or "E" sized drawing sheets as appropriate.

1. Overall plan view - may be superimposed on site topography, show general location, purpose, structure tie in with existing or planned layout.
2. Profile - along centerline of structure requires dimensional view and detailing views. Do not use the same view for both purposes except for very simple, single mat structures.
3. Sectional views - as required for clarity.
   a. Dimensions
   b. Detailing
4. Hydraulics.
5. Reinforcing steel schedules.
6. Table of quantities - estimates.
7. Construction notes - add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction plans shall include the following statement: **"According to South Dakota**

State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."

8. Location or vicinity map - Class IV or larger; show location of work from nearest city, town, etc. For other classes, use location map with legal description.
9. Job approval - ref.: ENG Memo SD-8.
10. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: South Dakota Specification Guide for the intended practice.

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys - record in field notebook
   1. Centerline and location alignment stakes.
   2. Reference stakes - include extensions of the structural members to a point outside of the immediate construction area.
   3. Grade stakes.

B. Quantities - final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance checking - record on field notes or construction plans.
   1. Construction surveys and measurements made during construction.
   2. Structural dimensions, controlling elevations, appurtenances, etc.
   3. Material certification records (ref.: NEM, 512.20).
   4. Materials testing results.
   5. Construction inspection report - (ref.: NEM, SD512.32).
   6. Statement of compliance - state that construction is complete according to plans and specifications. This should be dated and signed by the technician making the determination.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of need for

"As Built" plans will be made by the person exercising Job Approval Authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

GRASSED WATERWAY (412)

I. GENERAL

A. References
1. EFM, Chapter 2, Chapter 3 (pages 3-37 to 3-47), and Chapter 7.
2. SDTG (412).
3. SCS-TP-61, "Handbook of Channel Design for Soil and Water Conservation."
4. South Dakota Engineering Technical Notes.
   a. Hydrology - SD-1 - Determining Capacity of Natural Waterways.
   b. Construction - SD-1 - Construction Tolerances.
5. Computer software - Ohio, Missouri Waterways

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Drainage area.
2. Safe velocity for soil type.
3. Location of underground utilities.
4. Estimate probable end area to determine if area is greater or less than 35 square feet.
5. Locations of waterway outlets considering erosion, sedimentation, and drainage laws.

B. Design Surveys
1. Centerline profile and cross sections as needed to provide information for design and quantities computations.
   a. Estimated cross-sectional area is less than 35 square feet, natural channel slope 1.5 percent or greater, and control of waterway channel grade is not required.
      1. Use either hand level or engineering level.
      2. Check slope at a minimum of two locations per reach.
      3. Take two or more representative cross sections per reach as needed to estimate volume.
   b. Estimated cross-sectional area is more than 35 square feet, or natural channel slope less than 1.5 percent, or control of waterway channel grade is required.
      1. Use engineering level.
      2. Use benchmark and record description, location, and elevation.
      3. Run profile and obtain sufficient cross sections to adequately design waterway and estimate volumes.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.
1. Cultural resources inventory - use form SD-SSC-1.

2. Wetland effects.
    a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited Minimal Effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a Minimal Effect Agreement must be signed by owner.
    b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design data - record on form SD-ENG-29 or -29a or provide printout from software (OHIO or Missouri Waterways Engineering Programs).
    1. Hydrologic data - peak design flows for each reach.
    2. Hydraulic determinations - safe velocities for each reach based on soils and/or vegetal retardance.
    3. Determine required dimensions and capacity for each reach.
    4. Earthwork quantities - estimates as needed.

B. Permits and Approvals
    1. 404 permit (if applicable) - document if individual permit obtained, nationwide permit applies, or if practice is exempt.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction plans - use form SD-ENG-3, SD-ENG-25 (Job Plan 8.0), or appropriate "E" or "N" sized sheets.
    1. Overall plan view - may be superimposed on location map. Show stationing and identify reaches.
    2. Profile - centerline of waterway. Show original ground superimposed on design, grade, stationing, reaches, etc. Centerline profiles are required on waterways requiring grade control or cross-sectional areas greater than 35 square feet. Also, for other waterways as needed based on judgment of technician with Job Approval Authority.
    3. Cross sections - show typical cross sections for each reach.
    4. Construction notes - add notes to clarify or furnish direction in construction.
        a. On waterways with cross-sectional area less than 35 square feet that were surveyed with a hand level, the statement "**The completed waterway shall have no reverse grade.**" is required. The statement is optional on waterways surveyed with an engineering level.
        b. Construction plans for grassed waterways shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
    5. Quantity estimates - place on plans.
    6. Job approval – ref.: NEM, Part 501.
    7. Location or vicinity map - location map with legal description.
    8. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: South Dakota Specification Guide for Grassed Waterway or Outlet.

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Cross-sectional areas less than 35 square feet and waterways not requiring grade control - use hand level or engineering level and record in field notebook or on form SD-ENG-3.

1. Set stakes for alignment, depth, and grade as needed.
2. Obtain sufficient cross sections per design reach to estimate cross-sectional areas and earthwork quantities, if needed. Final quantities are based on staked lines and grades or approved changes.

B. Cross-sectional areas greater than 35 square feet or waterways requiring grade control - use engineering level, record in field notebook or on form SD-ENG-3.

1. Set a minimum of one reference stake or slope stake at each station to control alignment and grade as designed.
2. Set stations on grade or land slope changes and at an interval based on the judgment of the technician with Job Approval Authority. Recommended maximum interval - 100 feet.
3. Obtain sufficient cross sections per design reach to calculate volumes by average end area method. Final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance Checking - record in field notes or on SD-ENG-3.

1. The same engineering equipment should be used to the same degree of intensity as used in design and construction check surveys.
2. Check profile for grade.
3. Check width, depth, and side slopes. Minimum of one cross section per design reach.
4. Measure length.

5. Statement on temporary or permanent erosion control measures installed.
6. Statement regarding status of seeding.
7. Construction inspection report - form SD-ENG-19 – ref.: NEM SD512.32.
8. Statement of compliance - state that construction is complete according to plans and specifications. Date and sign by the technician with job approval authority.

B. "As Built" Plans - (ref.: NEM, 512.51 and 512.52)

"As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising job approval authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

IRRIGATION LAND LEVELING (464)

I. GENERAL

A. References

1. EFM, Chapter 15.
2. SDTG, Section IV.
3. South Dakota Irrigation Guide.
4. NEH, Section 15.
5. Irrigation plan for the unit.
   a. The proper field arrangement and farm distribution system must be planned before leveling is designed or installed. (Ref: Irrigation Planning Section of South Dakota Irrigation Guide.)
6. Computer software - Plane Surface Design (PSD), Terramodel, (or other design software).

II. INVESTIGATIONS AND SURVEYS

A. Design investigations

1. Detailed soil survey for irrigation - the published soil survey data is generally not detailed enough for the information required for land leveling design. A soil survey should be completed on the leveling area to determine irrigation suitability, topsoil depths, depth to gravel, and presence of any other features which would affect the designers decisions on allowable depth of cut, suitable borrow areas, etc.
2. Source, quantity, and quality of water.
3. Location of underground utilities.

B. Design Surveys

1. Topography or topographic map of survey area. Typically the area will need to be gridded prior to making the survey. The grid points will provide reference points to use later when construction staking is completed. A topographic survey may be of value prior to making the grid survey on irregular shaped fields which have very gradual and irregular slopes. The resulting contour map can be useful in determining the most efficient direction to level, which will then determine the direction for grid layout.
2. Grid point elevations - field notebook, grid sheet, or data collector (total station surveys).
3. Water surface elevations for supply and wastewater outlets.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.

1. Cultural resources inventory - use form SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a Minimal Effect Agreement must be signed by owner.

b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design data - record on land leveling grid (SCS-ENG-313, SCS-ENG-42, or CADD printout/plot).
   1. Determine and record ground elevation, design elevation, and cut/fill amounts for grid points.
   2. Planned grades for each field or bench.
   3. Supply laterals and drains.
   4. Location and elevations of structures, pads, ditches, etc., needed.
   5. Balance lines as needed (areas within which volumes of cut and fill are balanced).
   6. Quantity and cost estimates (SD-ENG 12).

B. Permits and Approvals (if applicable)
   1. Water rights - owner is responsible for obtaining water rights from SD DENR or properly filing a Location Notice; see GM, 450, Part 405. Document with form SD-ENG-4.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans
   1. Overall plan view showing cuts and/or fills on grid points, design elevations, and slopes.
   2. Location of ditches, drains, field laterals, structures, pads, and roads.
   3. Balance lines as needed.
   4. Show location and extent of borrow areas as needed.
   5. Table of quantities - estimates.
   6. Location or vicinity map - with legal description.
   7. Construction notes - add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction Plans for land leveling systems shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
   8. Job approval - see NEM, Part 501.
   9. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

   Ref: South Dakota Specification Guide for the intended practice.
   1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
   2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
   3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys (use field notebook).
   1. Mark, cut, or fill on grade stakes at grid points.
   2. Location and grade stakes for ditches, ditch pads, drains, etc.

B. Earthwork quantity computations
   1. Quantities are based on design elevations or approved changes. Yardage volumes may be obtained using appropriate design software, or one of the manual computation methods in NEH 15, Chapter 12.

VI. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance checking - record on field notes or construction plans (SD-ENG-19).
   1. Rod reading of elevations along selected lines showing constructed elevations and grades. Record in field notebook, on construction plan grid sheet or using data collector. Check down slope and cross slope in selected locations.
   2. Recheck notes or elevations on parts of field that had to be reworked.
   3. Visual check for overall workmanship.
   4. Construction inspection reports (ref: NEM, Part 512, Subpart D).
   5. Material certification statement (ref: NEM, Part 512, Subpart C).
   6. Statement of compliance - state that construction is completed according to plans and specifications. This should be dated and signed by the person with proper Job Approval Authority.

B. "As Built" Plans (ref: NEM, 512.51 and 512.52).
   "As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising Job Approval Authority in accordance with NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

IRRIGATION PIPELINE

Aluminum Tubing (430-AA)
High Pressure Underground Plastic (430-DD)
Low Pressure Underground Plastic (430-EE)
Steel (430-FF)
Reinforced Plastic Mortar (430-GG)

I. GENERAL

A. References

1. EFM, Chapters 3 and 5.
2. South Dakota Irrigation Guide.
3. NEH, Part 652, Irrigation Guide.
4. NEH, Sections 15, Irrigation, and 3, Hydraulics
5. SDTG, Section IV.
6. South Dakota Standard Engineering Plans (Job Plans).
7. Irrigation plan for the unit – ref.: Irrigation Planning Section of South Dakota Irrigation Guide.
8. South Dakota Engineering Technical Notes.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations

1. Soil borings- record on form SD-ENG-45 or SD-ENG-10 to determine trench and bedding requirements, as needed.
2. Corrosion potential or conditions (for metal pipe) - soil resistivity readings or other published soils data.
3. Location of underground utilities.

B. Design Surveys

1. Profile along centerline of pipeline - include all control points, such as structure elevations, critical field elevations, road crossings, drain points, etc.
2. Topographic map - where required to aid in positioning pipeline, determine outlet locations, irrigation methods, etc.
3. All pertinent water surface elevations - water supply ditch, check structures, high water marks, etc.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.

1. Cultural resources inventory- use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited Minimal Effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal, then a Minimal Effect Agreement must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design data - record on standard data sheets and/or appropriate worksheets.
   1. Capacity requirements - determination of design capacity; such as peak consumptive crop use, irrigation method requirements, irrigation water availability (may be determined by others on group systems or projects).
   2. Hydraulic data - use form SD-ENG-5, 5b, 7, 9, or 9a.
   3. Structural design computations, depending on structural needs.
   4. Quantity and cost estimates (SD-ENG 12).

B. Permits and Approvals (if applicable)
   1. Water rights - owner is responsible for obtaining water rights from SD DENR; see GM, 450, Part 405. Document with form SD-ENG-4.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use South Dakota standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of "E" (21" x 30,") 11"x17," or "N" (10 1/2" x 15") sized, drawing sheets.

   1. Overall plan view - should be of sufficient size to show alignment, stationing, areas involved, cultural features, reference points, and pipeline appurtenances.
   2. Profiles and design grades - show original ground surface and pipeline invert elevations and grades. Should show stationing, appurtenances, and other information related to construction.
   3. Hydraulics - pipe capacities and pressures
   4. Structural details - as needed to clarify drawings and show construction details, include plan views and sectional views.
   5. Table of quantities - estimates.
   6. Location or vicinity map - with legal description.
   7. Construction notes - add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction Plans shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
   8. Job approval - see NEM, Part 501.
   9. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities".

B. Construction Specifications

Ref: South Dakota Specification Guide for the intended practice.

   1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.

2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys (use field notebook)
1. Centerline alignment stakes.
2. Offset grade stakes.
3. Location and grade stakes for structures and pipeline appurtenances.
4. Quantities - final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance checking - record on field notes or construction plans (SD-ENG-19).
1. Profiles of pipe trench bottom (on short pipelines a minimum of three measurements required to determine depth of cover).
2. Measured length of lines by sizes, kinds, and classes or types of pipe, including stations of all appurtenances.
3. Elevations at water control structures.
4. Pipe gauges, thickness, pressure ratings, and markings.
5. Protective coating used and/or cathodic protection provided.
6. Number, type, location of appurtenances including drains, screens, valves, pressure regulators, outlets, air vents, stand pipes, etc.
7. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
8. Material certification statement (ref.: NEM, Part 512, Subpart C).
9. Statement of compliance - state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. "As Built" Plans (Ref: NEM, 512.51 and 512.52).
"As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising Job Approval Authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal

construction tolerances, and methods of mathematical computation, should be considered as significant.

PIPELINE

Pipeline (516)

I. GENERAL

A. References

1. SDTG (516).
2. EFM, Chapters 3 (page 3-83 to 3-88), and Chapter 12 (pages 12-42.1SD and 12-49SD).
3. South Dakota Engineering Technical Notes.
4. NEM, Part 503 (Engineering Activities Affecting Utilities).
5. Design needs for domestic use - "Planning for an Individual Water System" by AAVIM.
6. Montana Stockwater Pipelines (NRCS, Bozeman, Montana).
7. NDPIPE (North Dakota Pipe software used for pipeline hydraulics calculations).

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations

1. Livestock served in each pasture, total livestock served by system, season of use, number of farmsteads and houses.
2. Soils and geologic investigation - as required; determine routes considering soil depths and topography.
3. Source of water - available flow rates, depth to water and expected temperature.
4. Pressure at source - existing pump model number, pressure tank sizes and ratings, artesian pressures, etc.
5. Outlets - planned location and type of outlets, including planned tank sizes, and pressure required at houses.
6. Location of underground utilities.

B. Design Surveys

1. Profile along centerline of pipeline adequate to determine pipeline control elevations and lengths. Use USGS quadrangles, precision altimeters combined with aerial photos, or total station surveys, as appropriate.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.

1. Cultural resources inventory - use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a Minimal Effect Agreement must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design Data

Use form SD-ENG-48, Pipeline, SD-ENG-5C, Stockwater Pipeline Design Data, or other worksheet or software as applicable. SD-ENG-48 is used primarily for Engineering Job Class I or II (ref.: NEM 501.04) and for documenting a contractor's design.

1. Design flow based on livestock served, household needs, tank sizes, etc.
2. Hydraulic determinations to support pipeline sizes, pressure requirements, etc.
3. Pipeline sizes and pressure ratings for each pipeline reach.
4. Cost estimates.

B. Permits and Wetland Impacts

1. 404 Permit - document if individual permit obtained, nationwide permit applies, or if practice is exempt.
2. Domestic use for farm, ranch, household, and livestock use from other than a common water distribution system in excess of either 25,920 gpd (18 gpm continuously for 24 hrs.) or 25 gpm requires a water permit.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

Use "E" or "N" sized drawing sheets and Job Plan No. 12.0 as applicable and appropriate. Form SD-ENG-48 is adequate for a construction plan on installations utilizing conservation contractors for design and certification. Job Plan 12.1 is appropriate for Job Class I, II, and III pipelines of low complexity.

A. Construction Plans

1. Overall plan view - showing all pipelines, physical features such as roads, fences, public or private utilities, etc. Show pipeline identification, stationing, and appurtenance locations.
2. Profile along centerline of pipelines - required on Class IV sized jobs (ref: NEM, Part 501.04) or larger. Profiles may also be needed on smaller jobs of above average complexity dependent on the judgment of the technician having job approval authority. Show depths, appurtenances, pipe gradelines, hydraulic gradelines, static headline, changes in pipe sizes and ratings, etc.
3. Appurtenance details - show details of pipelines appurtenances such as water bars, manholes, stop and drain valves, air release valves, regulators, etc., as needed and applicable. (Ref.: Job Plan 12.0.)
4. Construction notes - add notes to clarify a component and furnish directions for installations, supplementing standard specifications. Construction Plans for stockwater pipelines shall include the following statement: **"According to South Dakota State Law, no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
5. Location or vicinity map - show legal description and location from nearest town, city, etc., for Job Class IV and V. For other classes - location map with legal description.
6. Table of quantities.
7. Job approval - ref.: NEM, Part 501.

8. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

(Ref.: South Dakota Specification Guide for Pipelines)

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions. Construction Specification "Stockwater Pipeline RC20" may be used in place of separate construction specifications and material specifications for Job Class I, II, and III pipelines using plastic pipe.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

C. Layout Surveys

1. Alignment stakes and flags as needed to mark pipeline route (also identifies area inventoried for cultural resources) and locate appurtenances, pipe changes, waterbars, etc.

V. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance Checking - record in field notebook or on form SD-ENG-48 as applicable.

1. Length of all lines including stationing of laterals, appurtenances, pipe changes, and outlets.
2. Measured depth of lines (if checked during construction inspection).
3. Materials certification - record pipe markings. (All pipe shall be marked with: size, type of plastic, SDR or PR, ASTM, and manufacturer's name.) NSF seal must be marked on pipe if pipeline is to be used for potable water. Pipe not marked with applicable markings will require a manufacturer's written certification.
4. Construction inspection - (ref.: NEM, SD512.32).
5. Certification statement - practice components - form SD-ENG-2.
6. Statement of compliance - state construction is complete according to plans and specifications. This should be dated and signed by the technician making the determination.

B. "As Built" Plans (ref.: NEM,512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising Job Approval Authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.

2. Significant[1/] changes in linear measurement.
3. Final quantities - measured quantities based on design route, layout, or other approved changes.
4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

SPRING DEVELOPMENT

Spring Development (574)

I. GENERAL

A. References
1. SDTG, (574, 516, 614).
2. EFM, Chapters 3 and 12.
3. NEM.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil borings - record on form SD-ENG-45 or SD-ENG-10.
2. Livestock served in each pasture, total livestock served by the system, season of use, number of farmsteads and houses.
3. Geologic investigation - as required.
4. Location of underground utilities.

B. Design Surveys
1. Topographic information - record in field notes - as required for design.
2. Profiles and cross sections - as required.
3. Control elevations and locations of water levels.
   a. Impermeable or restrictive barriers.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.
1. Cultural resources inventory- use form SD-SSC-1.
2. Wetland effects.
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a Minimal Effect Agreement must be signed by owner.

III. DESIGN

A. Design Data
1. Estimated yield of spring, if such evidence exists.
2. Livestock or other water needs - ref.: SDTG Standards 614 and 516.
3. Delivery and overflow pipe.
   a. Hydraulics - to support size, etc.
4. Collection system.
   a. Pipe size determinations.
   b. Gravel or filter pack design.
5. Material quantity estimates.

B. Permits and Wetland Impacts

1. 404 Permit - document if individual permit obtained, nationwide permit applies, or if practice is exempt.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use Job Plan or appropriate "E" sized (21" x 30") or "N" SIZED (10 ½"x 15") NRCS plan sheets as deemed necessary.

1. Overall plan view - showing layout of collection system, delivery and overflow pipe, and watering facilities and fencing.
2. Profile - along centerline of collection system, collection box, delivery and overflow pipe, and watering facility. Show original ground level with facilities superimposed thereon, pertinent elevations, stationing, etc.
3. Cross sections - as applicable.
4. Gravel pack or filter gradations - as needed.
5. Structural details - collection box, barrier, etc., as necessary to clarify intent.
6. Location map with legal description.
7. Table of quantities - estimates - put on plans.
8. Construction notes - as needed for clarity of drawings, specifications, etc. Construction Plans for spring developments shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
9. Job approval - ref.: NEM, Part 501.
10. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: South Dakota Specification Guide for Spring Development.

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the check list of furnished specification or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys - record in field notebook.
   1. Set centerline alignment stakes for facilities.
   2. Offset grade or slope stakes.
   3. Location and grade stakes for structures.

B. Quantities of materials - final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING - "AS BUILT" PLANS

A. Compliance checking - record in field notebook or construction plans.
   1. Collection system
      a. Pipe - size, type, length.
      b. Installed elevations.
      c. Gravel pack - dimensions, extent, gradation, etc.
      d. Collection box - sizes, materials, elevations.
   2. Delivery system
      a. Pipe - size, type, length, elevations.
   3. Water facility.
      a. Type, overflow outlet pipe materials, size.
   4. Materials certification - ref.: NEM, SD512.21.
   5. Certification statement - practice components - form SD-ENG-2.
   6. Construction inspection report - form SD-ENG-19 - ref.: NEM, SD512.32.
   7. Statement of compliance - state that construction is completed according to plans and specifications. This should be dated and signed by the technician with Job Approval Authority.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).
   "As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising Job Approval Authority in accordance with the NEM, Part 501. Changes are super-imposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

STREAMBANK AND SHORELINE PROTECTION

Streambank and Shoreline Protection (580) (and Bio-Engineering)

I. GENERAL

A. References

1. SDTG, 580.
2. EFH; Chapter 16 (Streambank and Shoreline Protection), Chapter 18 (Soil Bio-Engineering for Upland Slope Protection and Erosion Protection), Part 653, Stream Corridor Restoration.
3. Technical Release 25 - Design of Open Channels; Technical Release 59 - Hydraulic Design of Riprap Gradient Control Structures.
4. EFM, Chapter 10.
5. National Water and Climate Center Technical Note 99-1, Stream Visual Assessment Protocol.
6. Applied River Morphology; Rosgen, 1996.
7. Stream Barb Design Note, Version 1, West Region Technical Specialists, 11/16/98.
8. Streambank Erosion Control Manual, U.S. Army COE, 3/93.
9. Federal Highway Administration HEC no. 23, Bridge Scour and Stream Instability Counter Measures (bendway weir design guidance).
10. Peak Flow Frequency Estimates through 1994 for Gauged Streams in South Dakota, U.S. Geological Survey, Open File Report 96-202, 1996.
11. Techniques for Estimating Peak-Flow Magnitude and Frequency Relations for South Dakota Streams, report 98-4055, 1998.
12. Stream Channel Reference Sites: An illustrated Guide to Field Technique - General Technical Report RM-245, USDA - Forest Service.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations

1. Aerial photographs - as needed to compare historical photos with current stream configuration to assess recent changes, alterations, sinuosity, etc.
2. Soils investigations - bed and bank materials of stream.
3. Channel characteristics of stable reaches upstream or downstream of project, including riparian vegetation, channel geometry, grazing influences, etc.
4. Assessment of causes relative to the stream instability - channelization, downcutting, grazing impacts, natural lateral migration, other man caused disturbances, etc.
5. Project location relative to habitat/range of threatened and endangered species.
6. Location of underground utilities.

7. Stream classification - stream segments to be protected shall be classified to insure protection measures are compatible with stream type.
    a. Field determined bank full stage.
    b. Bank full discharge (1.5 yr.).
    c. Survey data - as needed to determine stream type.
    d. Width/depth ratio - an index value computed using the bankfull width/mean bank full depth.
    e. Entrenchment ratio - a computed index value which is the flood prone width (which occurs at an elevation twice the maximum bankfull depth)/bankfull width.

B. Design Surveys
1. Site topography - as needed to show physical features of site.
2. Centerline profiles and cross sections - as needed upstream and downstream of project for water surface profile computation, stream classification, design, etc.
    a. Profiles of thalweg of channel, low bank height, water surface elevation.
    b. Location of stream morphology features - start and end of pool and riffle sections, etc.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.
1. Cultural resources inventory- use form SD-SSC-1.
2. Wetland effects.
    a. Streambank stabilization projects will usually involve locations which are under COE jurisdiction and may require permitting under 404 regulations. Other determinations of wetland effects not required unless project will affect wetlands beyond bed and bank of the stream being stabilized.

III. DESIGN

A. Design Data
1. Determine frequency vs. discharge data - use EFM2, TR55, or USGS flood frequency data as applicable. (Note: Hydrology determined with EFM2 and/or TR55 may not accurately reflect the bankfull geomorphic characteristics of natural channels, but may provide a quick approximation.)
2. Hydraulic analysis - determine stage, discharge, velocity relationships. Calculate water surface profile elevations as appropriate (WSP2, HEC-RAS).
3. Protective measure analysis.
4. Bank protection measures are appropriate - considering geomorphic principals, risk tolerance, economics, esthetics, etc.
5. Stability analysis - as appropriate for structural and/or bio-engineering measures.
6. Structural analysis (not required for standard plan practices).
7. Design elevations.
8. Material volume computations - includes estimates of earthwork, rock, vegetative components, geotextile and erosion control fabrics, etc.
9. Cost estimates (include estimates of labor hours provided by sponsor/owner).

B. Permits and Approvals

1. 404 Permit - document if individual permit obtained, nationwide permit applies, or if practice is exempt.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use standard drawing component details to the extent possible. These are available for many components on various Internet sites as CADD drawings available for download. These are to be supplemented by additional drawings or specification notes as needed on the drawings to provide full installation instructions. Larger or more complex structures require use of "N" or "E" sized drawing sheets as appropriate.

1. Overall plan view - may be superimposed on site topography; show location, stationing, planned protective measures, etc.
2. Profile - profile along centerline of stream channel, as needed.
3. Sectional views - as required for detailing, dimensioning, planned elevations, etc.
4. Table of quantities - estimates.
5. Location or vicinity map - for Class IV or larger, show location of work from nearest city, town, etc., for other classes, location map with legal description.
6. Job approval - ref.: NEM, Part 501.
7. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: South Dakota Specification Guide Streambank and Shoreline Protection, 580.

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed within job approval authority limitations.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys - record in field notebook.

1. Centerline and location alignment stakes.

2. Reference stakes - include extensions of the structural members to a point outside of the immediate construction area.
3. Grade stakes.
4. Quantities - final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance checking - record on field notes or construction plans.
1. Construction surveys and measurements made during construction checks.
2. Structural dimensions, controlling elevations, appurtenances, etc.
3. Materials testing results.
4. Construction inspection reports - (ref.: NEM, SD512.32).
5. Statement of compliance - state that construction is complete according to plans and specifications. This should be dated and signed by the technician making the determination.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).
"As Built" plans are a record of constructed facilities. Determination of the need for "As Built" plans will be made by the person exercising job approval authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities - based on layout stake notes, measured quantities, and/or design quantities as appropriate, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

SUBSURFACE DRAIN (606)

I. GENERAL

A. References
1. EFM, Chapter 14.
2. SDTG, 606.
3. NEH, Section 16.
4. Drainmod computer software.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Geologic survey as needed.
   a. Soil borings as needed (record on form SD-ENG-10 or SD-ENG-45).
   b. Soil survey.
2. Special studies such as ground water and hydraulic conductivity as needed for design.
3. Location of underground utilities.

B. Design Surveys
1. Topographic detail - as needed to reflect topography and details such as roads, fence lines, location, and elevation of test wells, etc., (field notes or data collector).
2. Profile along centerline of drain.
3. Cross sections off centerline as required.
4. Control elevations and locations of outlets, test wells, ground water, inlets, and junctions.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.
1. Cultural resources inventory- use form SD-SSC-1.
2. Wetland effects.
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a Minimal Effect Agreement must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design Data
1. Hydrologic computations (for surface drains) - record on form SD-ENG-29.
2. Capacity requirements for interception drains.

3. Spacing of lines and laterals.
4. Drain hydraulics.
    a. Size, type, and strength requirements for tile.
    b. Spacing of lines and laterals.
    c. Grade of slope of tile.
5. Filter design - kind, gradation, thickness, filter opening, etc.
6. Bedding material.
7. Drain appurtenances - inlets, vents, manholes, junctions, etc.
8. Quantities - estimates as needed.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

Use South Dakota standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of "E" (21" x 30,") 11"x17," or "N" (10 1/2" x 15") sized, drawing sheets.

A. Construction Plans

1. Overall plan view showing drain location, alignment, and appurtenances in relation to field boundaries and outlets. Show linear stationing, benchmark locations, and elevations.
2. Profile along centerline of tile line. Show original ground elevation, tile invert, inlets, outlets, vents, manholes and junctions, groundwater elevations, and borings profile.
3. Typical cross sections - show trench, tile, filter, etc.
4. Appurtenant structure and details - include dimensional plans and sectional views to clearly show all intended details for construction.
5. Filter gradations.
6. Construction notes as needed to clarify drawings. Construction plans for subsurface drains shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
7. Quantities estimates - place on plans.
8. Job approval - ref.: NEM, Part 501.
9. Location or vicinity map - location map with legal description.
10. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: South Dakota Specification Guide for Subsurface Drain.

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout survey - record in field notebook.
   1. Centerline alignment and offset stakes:
      a. Set centerline stakes at maximum 100-foot intervals.
      b. Offset grade stakes at maximum 100-foot intervals. Reference grade stakes to tile flow line to 0.01 foot.
      c. Location and grade stakes for appurtenances.

B. Quantities - final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING - "AS BUILT" PLANS

A. Compliance Checking - record in field notes.
   1. Profile of completed tile line and flowline - if possible.
   2. Lengths, sizes, kind, and grade of tile lines.
   3. Filter thickness and kinds of material.
   4. Location and dimensions of appurtenances.
   5. Outlet pipe - length, kind, size, vertical distance between invert of outlet pipe and normal water level in outlet ditch or stream.
   6. Construction inspection report - form SD-ENG-19 - ref.: NEM, SD512.32.
   7. Material certification statement (ref.: NEM, Part 512, Subpart C).
   8. Statement of compliance - state that construction is complete according to plans and specifications. Date and sign by the technician with job approval authority.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).
   "As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising job approval authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:
   1. Significant[1/] design changes.
   2. Significant[1/] changes in linear measurement.
   3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
   4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

TERRACE (600)

I. GENERAL

A. References
1. EFM, Chapters 2 and 8.
2. SDTG, Section IV.
3. South Dakota Engineering Technical Note, Design SD-5.
4. Computer software EFM2.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soils map.
2. Conservation plan for unit.
3. Location of underground utilities.
4. Locations of outlets considering erosion, sedimentation, and drainage laws.

B. Design Surveys
1. Parallel terraces.
   a. Topographic map of area as needed.
   b. On small parallel terrace systems where a topographic map is not considered necessary for design, the design survey is usually combined with layout surveys and recorded on Job Plan 9.0, Terraces. All supplementary design information (surveys, etc.), should be on field notes, CADD files, or worksheets.
2. Basin Terraces.
   a. Drainage area.
   b. Topographic detail for design purposes (where needed).
3. All other terraces - design survey is usually combined with layout survey and recorded on Job Plan 9.0, Terraces. All supplementary design surveys should be put on field notes.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.
1. Cultural resources inventory - use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a Minimal Effect Agreement must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design Data
1. Parallel terrace system - where topographic map is used for design.

a. Show layout of terrace system superimposed on topog showing terrace interval, alignment, spacing, planned cropping equipment width, etc.
b. Total estimated length.

2. All other terraces - including small parallel terrace systems as needed for terrace design.
   a. Terrace spacing.
   b. Vertical and horizontal interval.
   c. Planned terrace dimensions, grades, and lengths.
3. Basin Terraces.
   a. Hydrology.
   b. Cross-sectional computations for volumes.
   c. Earthwork volume estimates.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction plans - use Job Plan 9.0 or appropriate "E" or "N" sized sheets.

1. Parallel Terraces.
   a. Overall plan view showing terraces, spacing, gradient, and pertinent elevations. Delineate odd areas. Show turn row strips and farm roads as needed.
   b. Terrace cross section.
   c. Location map with legal description.
   d. Construction plans for terraces shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
   e. Quantities estimates - place on plans.
   f. Job approval - see NEM, Part 501.
   g. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."
2. All other terraces - including small parallel terrace systems. Use Job Plan 9.0 if appropriate. Most of the following can be obtained during the layout survey:
   a. Location map with legal description.
   b. Plan view sketch with terrace numbers.
   c. Terrace kinds (level, gradient, parallel, etc.)
   d. Average land slope.
   e. Vertical and horizontal intervals.
   f. Grade by section.
   g. Estimated length of each terrace.
   h. Terrace cross section.
   i. Total lengths.

j. Construction plans for terraces shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**

k. Table of quantities - final quantities are based on staked lines and grades/or approved changes.

l. Job approval - see NEM, Part 501.

B. Construction Specifications

Ref.: South Dakota Specification Guide for Terraces.

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys - record in field notebook for basin and large parallel terrace systems and Job Plan 9.0 for other terraces.

1. Centerline or baseline alignment stakes.
2. Basic structural staking - as required for fills and cuts not normally included in baseline staking, etc.

B. Quantities - final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance checking - record in field notes or on Job Plan 9.0.

1. Profile notes of channel and ridge for at least one of the new terraces. Cross-sectional notes of channel and ridge for the same terrace. The cross section should include the entire disturbed area of the terrace and must extend above the top of the terrace ridge on the uphill cut slope. The terrace selected should be the one that appears least likely to meet specifications if there is an apparent difference in the sizes of the terraces. In addition to minimum requirements for recorded data, the person doing the checking will run profiles and cross sections of as many terraces or parts of terraces as considered necessary to determine that all work meets specifications. Normally, sufficient terraces should be profiled so that approximately 10 percent or more of the total terrace length is checked.

Use the backside of Job Plan 9.0, Terraces, for additional cross sections or profiles. For larger projects, use field notebook and "E" or "N" sized drawing sheets as appropriate for plotting profiles and cross sections.

2. Compute channel cross-sectional area and record.
3. Check channel grades for gradient terraces and ridge grades for level terraces.
4. Statement as to adequacy of outlet protection when appropriate.
5. Size, slope, and type of closed conduits where appropriate.
6. Adequacy or status of seeding for grassed back and basin terraces.
7. Installed quantity of work or materials. Measure constructed length of each completed terrace, use measuring wheel, chain, or tape.
8. Construction inspection report - form SD-ENG-19 – ref.: NEM, SD512.32.
9. Statement of compliance - state that construction is complete according to plans and specifications, dated and signed by the technician with Job Approval Authority.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising job approval authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities - based on final measurements (as staked or approved).
4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

TROUGHS AND TANKS

Troughs and Tanks (614)

I. GENERAL

A. References
1. SDTG, 614.
2. South Dakota Standard Engineering Plans (Job Plans).
3. Montana Stockwater Pipelines (NRCS, Bozeman, Montana).

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Water source - flow rates available, dependability, presence of central storage, water level controls, (float or overflow).
2. Purpose - number of livestock served, season of use, number of tanks in pasture

B. Environmental Inventory
NEPA inventory of resources - document inventory on form SD-CPA-3.
1. Cultural resources inventory - use form SD-SSC-1.

III. DESIGN DATA - record on computation sheet (SCS-ENG-523A) or SD-ENG-47 worksheet.

A. Tank capacity requirements (number of livestock served, days of storage required).
B. Storage volume calculations.
C. Material quantity computations.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS
Use standard plans where possible, or "N" (10 ½" x 15,") or "E" (21" x 30") sized sheets as appropriate.

A. Construction Plans
1. Overall plan view of tank and facilities, including overflow/drain location and guard posts and timbers locations.
2. Section along centerline of tank, showing construction details such as inlet and outlet pipes, floor, walls, elevations, etc.
3. Location map with legal description.
4. Table of quantities.
5. Construction notes - add notes to clarify a component and furnish directions for installations, supplementing standard specifications.
6. Job approval – ref.: NEM, Part 501.
7. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

C. Layout surveys (record in field notebook)

1. Layout survey data as needed, including cut/fill stakes, drain outlet location, etc.

V. COMPLIANCE CHECKING - "AS BUILT PLANS"

A. Compliance checking - record in field notebook or construction plans.

1. Check on pertinent elevations, overflow/float, gravel base, guard posts and timbers, appurtenances, etc.
2. Sizes and dimensions of tank adequate to calculate storage volume.
3. Quantities - final quantities are based on construction plan or approved changes.
4. Construction inspection - (ref.: NEM, SD512.32).
5. Statement of compliance - state construction is complete according to plans and specifications. This should be dated and signed by the technician making the determination.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising Job Approval Authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Final quantities -may be based on standard job plan if no changes were made and work meets planned details.
3. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

WASTE MANAGEMENT STRUCTURE
Waste Management System (312)
Waste Storage Facility (313)
Sediment Basin (350)
Waste Treatment Lagoons (359)

I. GENERAL

Waste management systems include practice components required for the complete management of waste. Documentation requirements will be as outlined below in addition to the documentation requirements of the practice components used in the system.

A. References

1. SDTG, Section IV.
2. South Dakota Livestock Waste Management Manual (Cooperative Extension Service).
3. NEH, Part 651 - Agricultural Waste Management Field Handbook.
4. NEH, Part 650 - EFH.
5. South Dakota Engineering Technical Notes.
6. Agricultural Nutrient Utilization Worksheets.
7. SD DENR General Water Pollution Control Permit for Concentrated Animal Feeding Operations and Concentrated Swine Feeding Operations.
8. Midwest Plan Service, Livestock Waste Facilities Handbook (MWPS-18).
9. Midwest Plan Service, Livestock Waste Management Systems.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations

1. Soil borings - record on form SD-ENG-10.
   a. Ground surface elevation of each hole.
   b. Depth to ground water and seasonal high water table.
   c. Description of each soil material (silty sand, lean clay, etc.)
   d. Unified soil classification of each material (SM, CL, etc.)
   e. Munsell soil color name (light brown,olive grey, grey, etc.)
   f. Estimate of soil permeability of underlying materials (permeable, low permeability, etc.)
   g. Whether the materials are oxidized or unoxidized.
2. Inventory of system - method of operation, number of livestock, waste disposal methods, type of equipment, future expansion plans, crop rotations on planned disposal areas, etc., document as applicable, including a preliminary sketch of the proposed facilities to document planning discussions.
3. Location of underground utilities

B. Design Surveys

1. Topographic surveys - of sufficient extent to cover the feedlot and/or all anticipated development.
2. Profiles - along centerline of proposed pipelines, ditches, diversions, etc., if outside limits of topographic map.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.

1. Cultural resources inventory- use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Use HGM model to determine effects of structure. If effects are minimal, then a minimal effect agreement must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design Data

1. Hydrologic determinations - documentation as applicable. This would include printouts from EFM2 or TR-55 computer programs or software/spreadsheets used for AWMS design.
2. Hydraulic determinations - required to determine capacities, sizes and proportion of facilities such as pipelines, diversions, etc., forms SD-ENG-29, -29a, or computer software/spreadsheet printouts may be used.
3. Flood routing data from IOWA PONDS or SITES computer programs used to evaluate pipe sizes for sediment basins.
4. Manure production/volume calculations. Use hand calculations, design spreadsheets for storage computation and documentation from LOTUS, or EXCEL spreadsheets.
5. Structural design calculations.
6. Construction material estimates - material volume computations - includes estimates of earthwork, pipe, concrete, rock, vegetative components, geotextile and erosion control fabrics, or other appurtenances, etc.

B. Permits and approvals (if applicable)

1. 404 Permit - document if individual permit obtained, nationwide permit applies, or if practice is exempt.
2. DENR approval - required if system designed for 1,000 A.U. or more, or if operator wants certificate of compliance under General Water Pollution Control Permit for Concentrated Feeding Operations.
3. Local ordinance approval - if applicable.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

Items are in accordance with planned decisions and specifications are sufficient to inform owner and contractor of construction requirements within Service standards.

A. Construction plans - use “E” (21” x 30,”) or “N” (10½” x 15,”) or other size drawings, as applicable.

1. Overall plan view - of sufficient detail to show all structural alignment, sizes, stationing, elevations, reference points, cultural features, and other details of the facility so they can be located and laid out in the field. May be superimposed on site topography.
2. Profiles - show intended grades, elevations, stationing, pipes, and similar structures. The profiles need to be in sufficient detail for construction layout and construction purposes. May be superimposed on original ground surface or described on overall plan view as needed for clarity.

3. Location or vicinity map - legal location map showing location from nearest town, etc.
4. Cross section - as needed to show all pertinent details such as side slopes, berms, bottom widths, and elevation. May be plotted or described on overall plan view as needed for clarity.
5. Structural details - includes dimensional plan views, sectional views to clearly show all needed details for construction. Reinforced concrete requires separate sectional and detailing views on all but simple projects. Standard plans developed by others should not require additional sectional and detailing views and schedule.
6. Table of quantities - estimates - place on plans.
7. Construction notes - add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction plans shall include the following statement: **"According to South Dakota State Law, no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
8. Job approval authority - (ref.: NEM, Part 501).
9. When plans are delivered to the cooperator, use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications (ref.: South Dakota Specification Guide for the intended practice).

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed within Job Approval Authority limitations.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout surveys - record in field notebook

1. Centerline alignment and reference stakes.
2. Grade and slope stakes.
3. All structural location alignment and reference stakes. Includes extensions of structural members to a point out of immediate construction area.

B. Earthwork Quantity Computations

Use standard forms or engineering software or spreadsheets to calculate where possible. Final quantities are based on staked lines and grades or approved changes.

VI. COMPLIANCE CHECKING - "AS BUILT" PLANS - record on field notes or on plans.

A. Compliance checking

1. Profiles and cross sections - at least two cross sections taken perpendicular to each other for each structure.
2. Measured length of lines by sizes, kinds, and classes of pipe.
3. Materials certification statement (ref.: NEM, Part 512.23).
4. Number, type, location of appurtenances (inlet structures, pipe supports, valves, stand pipes, etc.)
5. Construction inspection reports (ref.: NEM, Part 512.32).
6. Practice component certification statement - as needed - form SD-ENG-2.
7. Results of required testing (concrete, pressure, soil proctor, compacted soil density, soil moisture, soil permeability, etc.)
8. Statement of compliance - state that construction is complete according to plans and specifications. This should be dated and signed by the technician making the determination.
9. Certification of compliance by design engineer to DENR for NPDES permit (if applicable).

B. "As Built" Plans - (ref.: NEM, Parts 512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of the need for "As Built" plans will be made by the person exercising Job Approval Authority in accordance with the NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

WATERSPREADING (640)

I. GENERAL

A. References
1. EFM, Chapter 18.
2. SDTG, Section IV.
3. South Dakota Engineering Technical Note Design SD-2.
4. Computer Software - sites 98.0, EFM2, TR-55.
5. South Dakota Irrigation Guide.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Soil survey of spreading area to determine suitability of soils.
2. Soil borings - as required.
3. Determine spreading area (consider water supply available for dependable and questionable yields).
4. Evaluate drainage area characteristics, (local knowledge on water yields, flow durations, etc.)
5. Location of underground utilities.

B. Design Surveys
1. Topography or topographic map of survey area. Determination of need by individual who will exercise Job Approval Authority. A topographic map will normally be required for systems over five acres in size (total station survey) to include the spreading area as well as the storage pool of any retention dams.
2. Locate and survey centerline of existing diversions and proposed diversions and supply channels.
3. Locate all control elevations, outlets, etc.

C. Environmental Inventory

NEPA inventory of resources - document inventory on form SD-CPA-3.
1. Cultural resources inventory - use form SD-SSC-1.
2. Wetland effects (if applicable).
   a. Complete form SD-CPA-10 (South Dakota Minimal Effects Procedure). If project meets criteria in Step 4, use expedited minimal effect. If the site does not meet the criteria, proceed to Step 5 for functional assessment (HGM). If effects are minimal then a Minimal Effect Agreement must be signed by owner.
   b. Use form SD-ECS-7 to record effects for artificial wetlands.

III. DESIGN

A. Design Data - record on standard data sheets and/or appropriate worksheets.
1. Hydrologic data - peak flow, storm runoff, annual yield (form SD-ENG-29 or -29a, EFM 2, TR-55, SITES98) and flow duration.

2. Hydraulic requirements - supply channel requirements, ditches, dikes, structures, emergency spillways, drains, etc.
3. Type of spreading system to be installed.
4. Design water requirements (dependable/questionable water supply).
5. Structure data - surface area, storage, sediment volume, structural design as needed.
6. Structural design computations, depending on structural needs.
7. Quantity and cost estimates (SD-ENG 12).

B. Permits and approvals (if applicable).

1. 404 Permit - document if individual permit obtained, nationwide permit applies, or if practice is exempt.
2. Safety of dams - when a structure is classified as a 'dam' by SD DENR, the design shall be submitted to DENR for approval (see GM, 450, Part SD 405, for classification information).
3. Water rights - owner is responsible for obtaining water rights from SD DENR or properly filing a Location Notice; see GM, 450, Part 405. Document with form SD-ENG-4.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans

Use South Dakota standard plans to the extent possible. These are to be supplemented by additional drawings or specification notes on the drawings to provide full installation instructions. Larger or more complex structures may require use of "E" (21" x 30,") 11"x17," or "N" (10 1/2" x 15") sized, drawing sheets.

1. Overall plan view - may include topography, layout and location of diversions, ditches, dikes, structures, spillways, drain pipes, and streams. Show all necessary elevations, linear stationing and other details of construction.
2. Profiles of supply channels, dams, pumping stations, emergency spillways, and outlet pipes as necessary for clarity of drawings.
3. Cross sections - show typical cross sections of ditches, supply channels, dikes and dams, emergency spillways, etc.
4. Structural details as needed to clarify drawings.
5. Log of soil borings.
6. Show location and extent of borrow area.
7. Table of quantities - estimates.
8. Location or vicinity map - with legal description.
9. Construction notes - add notes to clarify a component and furnish directions for installations by supplementing standard specifications as needed. Construction plans for water spreading systems shall include the following statement: **"According to South Dakota State Law no excavator may begin any excavation without first notifying the One-Call Notification Center of the proposed excavation. 1-800-781-7474."**
10. Job approval - see NEM, Part 501.
11. When plans are delivered to the cooperator - use form SD-ENG-11 to inform cooperators and certify their understanding of the "participant responsibilities."

B. Construction Specifications

Ref.: South Dakota Specification Guide for the intended practice.

1. Use South Dakota Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.
3. Include cover sheet.

NOTE: Where South Dakota Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specification or a listing on the construction plans will be in the practice file. Additions to the South Dakota specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys (use field notebook).
   1. Centerline alignment and cut/fill stakes.
      a. Dikes - front toe every 100 feet with centerline and back toe approximately every 400 feet.
      b. Spreader ditches - alignment or baseline stakes at 50-foot intervals. Upper slope stake on approximately 300-foot intervals to assist the contractor in elevation control.
      c. Supply or drainage ditches.
   2. Structure location, alignment, and elevations (drain pipes, water control structures, etc.).
   3. Diversion dams - refer to layout section for earth dams.

B. Earthwork Quantity Computations
   1. Compute from layout notes - final quantities are based on staked lines and grades or approved changes. Spreader ditches based on lineal feet from layout notes or approved changes.
   2. Methods to be used in making computations of quantities:
      a. EFM, Supplement No. 1 (SD-ENG-33).
      b. Three level section (SD-ENG-32).
      c. Any level method (SCS-ENG-529, Technical Note Engineering Design SD-1).
      d. Computer software - Areavol, Ohio Cross Sections with quantities.
   3. Show quantities of all components in the table of quantities on the plans.

VI. COMPLIANCE CHECKING - "AS BUILT" PLANS

A. Compliance checking - record on field notes or construction plans (SD-ENG-19).
   1. Profiles on centerline of embankments, channels, dikes, and ditches.
      a. Check a minimum of one or more dikes or ditches per system. Sufficient checks will be made by the checker as considered necessary to determine that all work meets specifications.
   2. Cross sections of emergency spillways, dam embankments, channels, ditches, etc.
   3. Elevations and lengths of inlet and outlet of drain tubes, control structures and other appurtenances.

4. Pipes - check length, gauge, thickness, type, diameter.
5. Construction inspection reports (ref.: NEM, Part 512, Subpart D).
6. Material certification statement (ref.: NEM, Part 512, Subpart C).
7. Statement of compliance - state that construction is completed according to plans and specifications. This should be dated and signed by person making the determination.

B. "As Built" Plans (ref.: NEM, 512.51 and 512.52).

"As Built" plans are a record of constructed facilities. Determination of need for "As Built" plans will be made by the person exercising Job Approval Authority in accordance with NEM, Part 501. Changes are superimposed in a different color (usually red) on the official file copy and show:

1. Significant[1/] design changes.
2. Significant[1/] changes in linear measurement.
3. Final quantities - may be based on layout stake notes, if no changes were approved and work meets planned lines and grades.
4. Identify as "As Built" on plans.

[1/] Determination of "significant" is a matter of judgment by the technician. As a general rule, changes which exceed normal measuring error allowances, normal construction tolerances, and methods of mathematical computation, should be considered as significant.

WELL (Livestock and Domestic)

Well (642)

I. GENERAL

A. References
1. SDTG, Well (642).
2. EFM, Chapter 12.
3. Excerpts Water Laws and Regulations of the State of SD (ref.: GM, Title 450, Part 405). For wells where domestic use is planned or anticipated, SD DENR, Office of Drinking Water regulations for sanitation apply.

II. INVESTIGATIONS AND SURVEYS

A. Design Investigations
1. Geological review - as required.
2. Well location.
3. Location of underground utilities.

III. DESIGN

A. Design Data
1. All significant and appropriate design information required for design purposes.
2. Sanitary protection requirements where water is intended for household or dairy sanitation use.
3. Artesian pressure confinement protection.

B. Permits and Approvals (as applicable)
1. Domestic use for farm, ranch, household, and livestock use from other than a common water distribution system in excess of either 25,920 gpd (18 gpm continuously for 24 hrs.) or 25 gpm requires a water permit.

IV. CONSTRUCTION PLANS AND SPECIFICATIONS

A. Construction Plans
1. Location map - use form SD-ENG-51 or other suitable design sheet, as applicable.
2. Completion of other appropriate parts of form SD-ENG-51.
3. Sanitation protection requirements, as required.
4. Plan view of facility - as required to show diversions, fencing, clearing, etc.

B. Construction Specifications

Ref.: SD Specification Guide for the intended practice.
1. Use SD Construction and Material Specifications for each item of work and material, as applicable and available. Additional specifications may need to be written to provide full material and installation instructions.
2. Fill in blanks and add or delete items from the specifications to make them fit the job as needed.

3. Include cover sheet.

NOTE: Where SD Construction and Material Specifications are used and are not modified, a copy of the checklist of furnished specifications or a listing on the construction plans will be in the practice file. Additions to the SD specifications or specifically developed specifications should also be in the file.

V. LAYOUT

A. Layout Surveys - record in field notebook.
1. As required for location, diversion, fencing, etc.

VI. COMPLIANCE CHECKING - "AS BUILT" PLANS

A. Compliance Checking
1. Obtain all significant and appropriate construction information as required on form SD-ENG-51 including:
a. Drilling log (ref.: footnote[1/] on form SD-ENG-51); form SD-ENG-45 could be used if drilling contractor does not have his own log forms.
b. Water quality sample - SD Well Construction Standards require "following completion of any public water supply or any well for domestic use, a water sample shall be collected and submitted." The owner is responsible for collecting and submitting the sample unless the well is operational when completed by the driller, in which case, the driller is responsible for submitting the sample.
2. Adequacy of pumping equipment, storage and water facility - if installed at time of compliance checking.
3. Material certification records (ref.: NEM, Part 512).
4. Construction inspection report (ref.: NEM, Part 512).
5. Well Driller's Compliance Certification - form SD-ENG-51.